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Modeling and Observational Study of Drizzle Production in Stratocumulus Clouds Over the Southern Ocean

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LONG TERM GOALS

Testing and refinement of the drizzle parameterization for conditions typical for stratocumulus cloud layers over the Southern Ocean.

OBJECTIVES

The objective is to study the drizzle production in marine stratocumulus under conditions of high winds and heavy drizzle typical for the Southern Ocean. The OU/CIMMS five-moment drizzle parameterization will be tested and generalized for use under these conditions.

APPROACH

The study will involve numerical simulations using the 3-D model with explicit (spectral) formulation of aerosol and cloud drop size-resolving microphysics, as well as observational analysis of data from the Southern Ocean Cloud Experiment (SOCEX).

WORK COMPLETED

The graduate student hired under this Grant started to work towards the Ph.D. degree at the OU School of Meteorology. He modified the CIMMS LES model to investigate the drop activation process in boundary layer clouds under strong surface wind conditions. Several LES simulations have been completed and verification of model results is now underway.

RESULTS

Cloud microstructure (characterized by drop concentration) depends in a complex way on surface winds, turbulence intensity, and CCN spectrum shape. The investigation of these effects required substantial modification of the model. Two new versions of the model have been developed: in the first the sea-salt aerosols are introduced at the surface boundary and their evolution is followed until and after they reach the cloud layer. The second version assumes that sea-salt aerosols are already well-mixed in the boundary layer, thus, the transport and mixing phase is skipped. Both versions will be used in order to understand the physical mechanisms that impact the formation of cloud microstructure.

RELATED PROJECTS

The ASSERT Grant is related to the parent grant funded by the ONR “Midlatitude Aerosol-Cloud-Radiation Feedbacks Mechanisms in Marine Stratocumulus Clouds” (N00014-96-1-0687).